

## CLAIMS

What is claimed is:

1. A roofing membrane, comprising:  
a continuous matrix of bitumen modified by addition of a polymer, the matrix being characterized as being substantially free of voids containing entrained air.
2. The roofing membrane of claim 1, wherein the modifying polymer is selected from a group consisting of: styrene-butadiene-styrene ("SBS") block co-polymer, atactic polypropylene ("APP"), and a combination of SBS and APP.
3. The roofing membrane of claim 1, wherein the bitumen is selected from the group consisting of straight run asphalts with a rod & ball softening point in the range of from 80 to 130 degrees F; oxidized asphalts, solvent washed asphalts, road tars, refined tars, and blends thereof.
4. The roofing membrane of claim 1, wherein the bitumen is modified by the polymer by adding the polymer to the bitumen while the bitumen is in a molten state in a sealed mixing vessel at a pressure inside the vessel of less than ambient.
5. The roofing membrane of claim 1, wherein the bitumen is modified by the polymer by adding the polymer to the bitumen while the bitumen is in a molten state until the polymer is completely dispersed in the bitumen, followed by residence of the modified bitumen in a sealed vessel at a pressure inside the vessel of less than ambient.
6. The roofing membrane of claim 4 wherein the internal pressure in the vessel is at least 15 inches Mercury less than ambient.
7. The roofing membrane of claim 5 wherein the internal pressure in the vessel is at least 15 inches Mercury less than ambient.
8. The roofing membrane of claim 1, wherein the modified bitumen continuous matrix embeds a reinforcing mat of fibers.

9. The roofing membrane of claim 1, wherein an upper or weathering surface of the membrane is coated with a granular material.
10. The roofing membrane of claim 9, wherein the granular material is a No. 11 ceramic roofing granule.
11. The roofing membrane of claim 1, wherein a lower or non-weathering surface of the membrane is coated with a means for preventing self-adhesion.
12. The roofing membrane of claim 11, wherein the means for preventing self-adhesion is a fine silica sand.
13. The roofing membrane of claim 1, wherein the modifying polymer is present in the modified bitumen in the range of from about 5 to about 30 percent by weight.
14. The roofing membrane of claim 2, wherein the bitumen is further modified by a secondary modifying polymer selected from the group consisting of styrene-isoprene styrene ("SIS"), styrene-ethylene-butylene-styrene ("SEBS"), styrene-ethylene ("SE") and combinations thereof.
15. The roofing membrane of claim 5, wherein the modifying polymer is added to the bitumen while the bitumen is agitated in a mixer at a temperature in the range of from about 300 to about 400 degrees Fahrenheit.
16. The roofing membrane of claim 1, wherein the roofing membrane exhibits no blistering from entrained air voids after being submerged in water at about 120 degrees F for 72 hours, then maintained at about 160 degrees F under at least 15 in. Hg vacuum for up to 48 hours.
17. A roofing membrane, comprising:  
a continuous matrix of bitumen modified by addition of a polymer, the matrix being characterized as being substantially free of voids containing entrained air;  
the modifying polymer being selected from a group consisting of: styrene-butadiene-styrene ("SBS") block co-polymer, atactic polypropylene ("APP"), and a combination of SBS and APP;

the bitumen being selected from the group consisting of straight run asphalts with a rod & ball softening point in the range of from 80 to 130 degrees F; oxidized asphalts, solvent washed asphalts, road tars, refined tars, and blends thereof;

wherein the bitumen is modified by the polymer by adding the polymer to the bitumen while the bitumen is in a molten state in a sealed mixing vessel where the bitumen is agitated at a temperature in the range of from about 300 to about 400 degrees Fahrenheit;

wherein the modified bitumen is exposed to a pressure during modification or after modification while still in a molten state of less than ambient, the pressure being at least 15 inches Hg less than ambient;

wherein a reinforcing mat of fibers is embedded in the matrix;

wherein an upper or weathering surface of the membrane is coated with a granular material;

wherein a lower or non-weathering surface of the membrane is coated with a means for preventing self-adhesion;

wherein the modifying polymer is present in the modified bitumen in the range of from about 5 to about 30 percent by weight.

wherein the bitumen is further modified by a secondary modifying polymer selected from the group consisting of styrene-isoprene styrene ("SIS"), styrene-ethylene-butylene-styrene ("SEBS"), styrene-ethylene ("SE") and combinations thereof.

18. A process for producing a roofing membrane, comprising the steps of:

providing a bitumen being selected from the group consisting of straight run asphalts with a rod & ball softening point in the range of from 80 to 130 degrees F; oxidized asphalts, solvent washed asphalts, road tars, refined tars, and blends thereof;

providing a modifying polymer being selected from a group consisting of: styrene-butadiene-styrene ("SBS") block co-polymer, atactic polypropylene ("APP"), and a combination of SBS and APP;

modifying the bitumen by adding the modifying polymer to the bitumen while the bitumen is in a molten state in a sealed mixing vessel where the bitumen is agitated at a temperature in the range of from about 300 to about 400 degrees Fahrenheit;

exposing the modified bitumen to a pressure less than ambient during or after modification while still in a molten state to allow release of entrained gases; and

forming the roofing membrane from the molten modified bitumen.